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1974 PACAF MOSQUITO IDENTIFICATION SUMMARY
WITH
A SHORT MOSQUITO SURVEILLANCE GUIDE FOR THE PACAF AREA

ENTOMOLOGY DIVISION

1st MEDICAL SERVICE WING (PACAF)
APO SAN FRANCISCO 96274

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1974 PACAF MOSQUITO IDENTIFICATION SUMMARY

WITH

A SHORT MOSQUITO SURVEILLANCE GUIDE FOR THE PACAF AREA

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TABLE OF CONTENTS

I. INTRODUCTION:

This report is partially a record of identifications of mosquitoes captured on PACAF bases during CY 1974. The majority of data begins in July or later, which coincides with the re-establishment of the vector taxonomy function of 1st Medical Service Wing (1MSEW). If data for the period of January-June 1974 are available from other sources, these data are included in the tables and proper acknowledgment is made.

A number of additional subjects have been addressed, with the expectation that the report will be useful as an abbreviated source of vector surveillance technique to base level organizations and thus serve as a tool to the field. With this goal in mind, sections have been prepared on use of light trap data, alternate mosquito surveillance methods, and proper specimen packing and shipping protocols. Also included are short biological data sketches on some of the more important disease vector species in the PACAF area, and a list of mosquito disease vectors and the diseases that they transmit.

Information contained in this report should allow more efficient accomplishment of base-level vector surveillance programs as required by PACAF Supplement 1 to AFR 161-1, by explaining why vector surveillance is necessary, how to modify the surveillance program to produce maximum results, and how to utilize the data collected for more effective control. The achievement of these goals will greatly aid PACAF Hospital Commanders and Environmental Health Service Offices in evaluating the threat of vector-borne disease on their bases.

It is anticipated that this yearly summary report will become a permanent fixture and that protocol improvements and information useful in conducting the base vector surveillance program will continue to be incorporated. Information or advice pertaining to USAF entomology can be obtained at any time by calling the Entomology Division, 1st Medical Service Wing, at Clark AB, extensions 33291, 33292, 33245, or 33246. Correspondence may be addressed to:

Hq 1st Medical Service Wing/SGBE
APO 96274

II. ACKNOWLEDGMENTS:

The assistance of the following organizations in the identification of mosquitoes during CY 1974 is gratefully acknowledged:

The Entomology Service, U. S. Army, 5th Preventive Medicine Unit, Camp Mosier, Korea, for identification of mosquitoes captured on USAF installations in Korea;

The Department of Entomology, U. S. Army Medical Laboratory, Pacific, Camp Zama, Japan, for identification of mosquitoes captured on USAF bases in Japan, and on Clark AB, Republic of the Philippines;

The Entomology Department, Preventive Medicine, USAMEDC, OL "Camp Bugs," Okinawa, for identification of mosquitoes captured on Kadena AB, Okinawa; and,

The Entomology Department, Naval Medical Research Unit No. 2, Taipei, Taiwan, for identification of mosquitoes captured on USAF installations on Taiwan.

III. BASE MOSQUITO SUMMARIES:

(Continued on overleaf)

ADULT MOSQUITOES: ANDERSEN AB, GUAM, 1974

Species	Jul	Aug
Aedes guamensis	108	34
Aedes vexans vexans	19	13
Anopheles vagus vagus	-	1
Culex quinquefasciatus	2	-
Culex sitiens	-	1
Aedes males	5	34
Culex males	2	-
TOTALS	136	82

LARVAL MOSQUITOES: ANDERSEN AB, GUAM, 1974

Species	Sep
Aedes vexans vexans	94

ADULT MOSQUITOES: CLARK AB, PHILIPPINES, 1974

Species	Aug	Sep	Oct	Nov	Dec
Aedeomyia catasticta	5	-	1	-	-
Aedes flavipennis	2	-	-	-	-
Aedes lineatopennis	37	4	-	3	-
Aedes poecilus	-	-	-	2	1
Aedes vexans vexans	60	21	9	62	2
Anopheles annularis	20	5	1	1	1
Anopheles barbirostris	-	-	1	-	-
Anopheles filipinae	2	-	-	-	1
Anopheles flavirostris	-	1	-	2	1
Anopheles indefinitus	59	25	18	2	-
Anopheles karwari	-	-	-	-	1
Anopheles ludlowae	1	-	4	-	-
Anopheles maculatus	1	-	-	1	-
Anopheles peditaeniatus	15	32	8	25	1
Anopheles philippinensis	1	-	-	-	-
Anopheles pseudobarbirostris	-	-	1	-	-
Anopheles subpictus	211	82	25	10	4
Anopheles tessellatus	-	-	-	8	-
Anopheles vagus limosus	39	17	9	2	2
Anopheles vagus vagus	61	35	14	8	15
Armigeres (species)	-	-	-	-	1
Coquillettidia (species)	-	-	1	-	-
Culex annulus	51	-	-	-	-
Culex bitaeniorhynchus	10	6	3	-	-
Culex fuscanus	-	1	-	-	-
Culex fuscocephala	149	29	11	59	23
Culex gelidus	49	32	5	5	11
Culex incognitus	222	17	7	3	1
Culex pseudovishnui	20	2	10	-	-
Culex quinquefasciatus	-	-	1	3	-
Culex tritaeniorhynchus	566	69	38	40	7
Culex vishnui (subgroup)	98	371	78	45	29
Culex whitmorei	20	18	18	50	4
Ficalbia luzonensis	2	5	-	1	3
Ficalbia (species)	-	1	-	-	-
Malaya genurostris	-	-	-	1	-
Mansonia annulata	-	-	-	-	1
Mansonia uniformis	6	2	2	3	4
Uranotaenia clara	-	-	-	1	-
Uranotaenia pylei	1	-	1	-	-
Uranotaenia testacea	1	-	1	-	-
Aedes males	8	-	1	5	3
Anopheles males	3	9	1	4	-
Coquillettidia males	-	-	1	-	-
Culex males	98	47	24	60	15
Ficalbia males	-	-	-	-	1
Mansonia males	-	-	-	-	8
Uranotaenia males	-	-	2	1	-
DAMAGED	81	156	37	28	4
TOTALS	1899	988	332	435	144

ADULT MOSQUITOES: CLARK AB, PHILIPPINES, 1974
Identified by U. S. Army Medical Laboratory, Pacific

Species	Apr
Aedeomyia catasticta	16
Aedes vexans	3
Aedes species	1
Anopheles indefinitus	14
Anopheles ludlowae	8
Anopheles peditaeniatus	2
Anopheles tessellatus	1
Anopheles vagus limosus	4
Anopheles (species)	3
Culex fuscocephala	2
Culex gelidus	4
Culex (species)	15
Aedes male	1
Anopheles male	5
Culex male	9
Mansonia male	1
DAMAGED	1
TOTAL	90

LARVAL MOSQUITOES: CLARK AB, PHILIPPINES, 1974

Species	Oct	Nov	Dec
Anopheles subpictus	1	-	-
Anopheles vagus limosus	1	-	-
Anopheles vagus vagus	1	-	-
Culex annulus	6	34	-
Culex fuscocephala	7	-	1
Culex sitiens	1	-	-
Culex tritaeniorhynchus	4	-	16
Malaya genurostris	1	-	-
Culex species	2	-	6
Zeugnomyia species	1	-	-
TOTALS	25	34	23

ADULT MOSQUITOES: HICKAM AFB, HAWAII, 1974

Species	Oct	Nov
Aedes vexans vexans	1	-
Culex quinquefasciatus	109	279
Culex males	24	127
DAMAGED	5	-
TOTALS	139	406

ADULT MOSQUITOES: KADENA AB, JAPAN, 1974
Identifications by U. S. Army Preventive Medicine Activity, Okinawa

Species	May	Jun	Jul	Aug	Sep
Aedes albopictus	-	2	1	-	-
Aedes vexans	10	8	8	2	1
Anopheles lesteri	1	6	1	1	-
Anopheles sinensis	3	1	2	2	-
Armigeres subalbatus	-	-	-	1	-
Culex bitaeniorhynchus	1	-	-	1	-
Culex fuscanus	1	-	-	-	-
Culex quinquefasciatus	124	7	1	2	-
Culex rubithoracis	-	-	1	-	-
Culex sitiens	-	-	-	-	4
Culex tayashii	-	-	1	-	-
Culex tritaeniorhynchus	5	6	20	35	4
Mansonia uniformis	-	-	1	2	3
Aedes males	3	1	-	-	-
Anopheles males	-	-	3	1	-
Culex males	94	92	11	9	6
Uranotaenia males	1	-	-	-	-
TOTALS	243	123	50	56	18

ADULT MOSQUITOES: KORAT RTAFB, THAILAND, 1974

Species	Jul	Aug	Sep	Oct	Nov	Dec
Aedeomyia catasticta	-	-	6	31	22	17
Aedes lineatopennis	-	1	2	6	1	-
Aedes mediolineatus	-	2	2	14	-	-
Aedes vexans vexans	17	360	228	272	37	4
Anopheles aconitus	-	-	1	4	2	8
Anopheles annularis	-	-	6	5	6	-
Anopheles argyropus	-	-	-	-	1	-
Anopheles campestris	-	-	-	1	-	-
Anopheles peditaeniatus	-	2	5	20	12	4
Anopheles philippinensis	4	4	17	35	14	3
Anopheles sinensis	-	-	-	-	-	1
Anopheles subpictus	2	3	8	1	2	-
Anopheles tessellatus	-	-	4	17	6	1
Anopheles vagus	-	15	20	31	2	2
Coquillettidia crassipes	-	-	1	2	3	1
Coquillettidia ochracea	-	-	-	2	-	-
Culex annulus	-	3	-	6	1	-
Culex bitaeniorhynchus	-	2	1	7	2	-
Culex fuscanus	-	-	-	3	2	1
Culex fuscocephala	6	25	48	88	34	15
Culex gelidus	5	136	295	581	131	202
Culex hutchinsoni	-	3	-	-	1	-
Culex nigropunctatus	-	-	3	5	3	-
Culex quinquefasciatus	2	12	6	4	-	19
Culex sinensis	-	-	-	2	2	-
Culex sitiens	-	-	-	4	-	-
Culex tritaeniorhynchus	26	64	44	97	43	17
Culex vishnui (subgroup)	-	15	34	160	37	34
Culex whitmorei	5	5	19	202	16	-
Culex (species)	-	-	-	5	1	-
Ficalbia chamberlaini	-	2	-	-	-	-
Ficalbia elegans	-	-	-	-	-	1
Ficalbia hybrida	-	-	-	4	1	4
Ficalbia luzonensis	-	1	5	20	5	13
Ficalbia minima	2	-	-	-	-	1
Ficalbia (species)	-	-	1	1	-	-
Mansonia annulata	-	-	-	-	-	2
Mansonia annulifera	-	3	3	7	13	2
Mansonia dives	-	-	-	1	-	-
Mansonia indiana	-	2	-	-	-	-
Mansonia uniformis	12	19	70	92	44	8
Uranotaenia annandalei	-	-	-	-	-	1
Aedes males	1	2	16	-	1	-
Anopheles males	-	-	1	-	-	-
Culex males	4	127	96	-	1	-
Ficalbia males	-	1	1	1	-	1
Uranotaenia males	-	-	1	-	-	-
DAMAGED	2	14	38	29	27	7
TOTALS	88	499	982	1760	473	369

ADULT MOSQUITOES: KUNSAN AB, KOREA, 1974
Identified by U. S. Army 5th Preventive Medicine Unit

Species	May	Jun
Aedes vexans	14	6
Anopheles sinensis	5	5
Culex bitaeniorhynchus	1	18
Culex pipiens	-	4
Culex tritaeniorhynchus	1	65
Culex vagans	10	69
Aedes males	9	3
Anopheles males	49	2
Culex males	6	51
TOTALS	95	223

ADULT MOSQUITOES: KUNSAN AB, KOREA, 1974

Species	Jun	Jul	Sep
Aedes vexans nipponii	-	45	7
Anopheles sinensis	-	382	183
Culex bitaeniorhynchus	1	12	4
Culex quinquefasciatus	-	53	6
Culex tritaeniorhynchus	21	880	112
Culex vagans	-	17	2
Aedes males	-	15	-
Anopheles males	-	84	147
Culex males	1	285	34
DAMAGED	-	47	31
TOTALS	23	1820	526

ADULT MOSQUITOES: KWANGJU AB, KOREA, 1974
Identifications by U. S. Army 5th Preventive Medicine Unit

Species	May	Jun	Jul
Aedes vexans	4	35	75
Anopheles sinensis	2	6	19
Anopheles sineroides	-	1	-
Culex pipiens	-	10	17
Culex tritaeniorhynchus	-	-	10
Culex vagans	2	14	-
Aedes males	2	28	7
Anopheles males	1	2	15
Culex males	1	17	12
TOTALS	12	113	155

ADULT MOSQUITOES: KWANGJU AB, KOREA, 1974

Species	Jul	Aug	Sep	Oct
Anopheles sinensis	25	121	158	21
Culex annulus	-	-	-	1
Culex bitaeniorhynchus	2	5	2	1
Culex pipiens pallens	-	-	2	-
Culex quinquefasciatus	13	18	36	7
Culex tritaeniorhynchus	13	385	211	56
Culex vagans	-	-	18	14
Culex vishnui (subgroup)	-	-	61	1
Anopheles males	20	73	175	51
Culex males	18	213	296	96
DAMAGED	-	438	219	31
TOTALS	91	1253	1178	279

ADULT MOSQUITOES: MISAWA AB, JAPAN, 1974

Species	Jul	Aug	Sep
Aedes vexans nipponii	5	-	-
Anopheles sinensis	5	4	17
Aedes males	1	1	-
Anopheles males	1	1	-
Culex males	-	-	3
DAMAGED	1	5	-
TOTALS	13	11	20

ADULT MOSQUITOES: NAKHON PHANOM RTAFB, THAILAND, 1974

Species	Jul	Aug	Sep	Oct	Nov	Dec
Aedeomyia catasticta	-	2	8	5	7	15
Aedes lineatopennis	-	-	1	-	-	-
Aedes mediolineatus	-	1	-	-	2	-
Aedes vexans vexans	1	1	1	-	-	-
Anopheles aconitus	-	-	-	3	-	-
Anopheles annularis	1	4	31	45	4	2
Anopheles argyropus	-	-	-	1	-	-
Anopheles kochi	-	-	1	-	-	-
Anopheles maculatus	-	-	-	-	-	1
Anopheles nigerrimus	-	-	-	1	1	-
Anopheles peditaeniatus	-	6	4	7	-	1
Anopheles philippinensis	6	38	73	60	1	1
Anopheles ramsayi	-	-	-	-	-	1
Anopheles vagus	4	1	-	-	2	-
Culex annulus	-	-	1	1	-	-
Culex bitaeniorhynchus	1	1	3	1	-	1
Culex fuscocephala	12	1	11	3	7	2
Culex gelidus	13	4	5	15	13	7
Culex halifaxii	-	-	-	-	1	-
Culex hutchinsoni	-	-	-	-	-	1
Culex nigropunctatus	-	-	2	-	-	-
Culex pseudosinensis	-	-	2	-	-	-
Culex quinquefasciatus	4	1	-	1	1	2
Culex sinensis	-	2	-	-	-	-
Culex tritaeniorhynchus	30	22	37	21	6	-
Culex vishnui (subgroup)	-	2	21	21	12	1
Culex whitmorei	20	8	39	10	1	-
Culex (species)	-	2	2	-	-	1
Ficalbia ludlowae	-	1	-	-	-	-
Ficalbia luzonensis	2	1	1	-	-	-
Mansonia annulata	-	-	-	-	-	1
Mansonia annulifera	-	1	1	1	-	-
Mansonia uniformis	4	4	1	1	-	-
Mansonia (species)	-	2	-	-	-	-
Uranotaenia campestris	-	-	1	1	-	-
Uranotaenia heiseri	1	-	-	-	-	-
Uranotaenia (species)	-	-	-	-	1	-
Aedes males	-	-	-	1	-	-
Anopheles males	3	1	6	3	2	-
Armigeres males	-	-	-	-	1	-
Culex males	16	10	34	19	9	5
Mansonia males	-	2	1	-	-	-
Uranotaenia males	-	-	-	1	-	-
DAMAGED	9	10	25	4	10	-
TOTALS	127	128	312	226	81	42

LARVAL MOSQUITOES: NAKHON PHANOM RTAFB, THAILAND, 1974

Species	Jul	Sep	Oct
Anopheles (species)	4	-	4
Culex annulus	-	1	-
Culex perplexus	-	1	-
Culex pseudovishnui	2	-	-
TOTALS	6	2	4

ADULT MOSQUITOES: OSAN AB, KOREA, 1974
Identified by U. S. Army 5th Preventive Medicine Unit

Species	May	Jun	Jul
Aedes vexans	13	69	44
Anopheles sinensis	-	34	46
Anopheles sineroides	-	2	2
Culex pipiens	-	-	7
Aedes males	8	40	10
Anopheles males	1	24	14
Culex males	-	-	7
TOTALS	22	169	130

ADULT MOSQUITOES: OSAN AB, KOREA, 1974

Species	Jul	Aug	Sep
Aedes koreicus	1	-	-
Aedes vexans nipponii	185	92	36
Anopheles sinensis	306	708	506
Anopheles sineroides	1	-	-
Culex bitaeniorhynchus	2	7	3
Culex mimeticus/jacksoni	1	-	-
Culex orientalis	-	6	-
Culex quinquefasciatus	3	12	20
Culex rubensis	-	1	-
Culex sitiens	2	1	-
Culex tritaeniorhynchus	24	215	38
Culex vagans	-	1	-
Culex vishnui	-	-	1
Mansonia uniformis	-	-	1
Aedes males	306	50	88
Anopheles males	65	183	196
Culex males	21	152	13
DAMAGED	94	231	176
TOTALS	1011	1659	1078

ADULT MOSQUITOES: SHU LIN KOU AS, TAIWAN, 1974
Identification by U. S. Navy Medical Research Unit No. 2

Species	Apr	May	Jun
Anopheles sinensis	4	4	14
Culex annulus	-	2	1
Culex bitaeniorhynchus	6	10	3
Culex kangi (subgroup)	1	-	-
Culex pipiens fatigans	28	3	6
Culex tritaeniorhynchus summorosus	1	-	5
Culex vagans	22	-	-
Anopheles males	2	-	6
Culex males	24	6	9
TOTALS	88	25	44

ADULT MOSQUITOES: SHU LIN KOU AS, TAIWAN, 1974

Species	Aug	Sep
Anopheles sinensis	15	1
Culex annulus	3	-
Culex bitaeniorhynchus	1	1
Culex tritaeniorhynchus	58	-
Culex vishnui (subgroup)	9	5
Ficalbia luzonensis	1	-
Mansonia uniformis	1	-
Culex males	2	-
DAMAGED	1	-
TOTALS	91	7

ADULT MOSQUITOES: UDORN RTAFB, THAILAND, 1974

Species	Aug	Sep	Oct	Nov	Dec
Aedeomyia catasticta	-	-	3	9	7
Aedes mediolineatus	6	5	5	2	-
Aedes vexans vexans	2	-	8	-	-
Anopheles aconitus	-	-	1	3	2
Anopheles annularis	-	-	5	5	-
Anopheles argyropus	-	-	1	-	-
Anopheles barbirostris	-	-	1	-	-
Anopheles campestris	-	-	-	1	-
Anopheles crawfordi	-	-	1	-	-
Anopheles nigerrimus	-	-	7	3	1
Anopheles peditaeniatus	1	-	6	7	1
Anopheles philippinensis	-	-	31	13	4
Anopheles ramsayi	-	-	-	2	-
Anopheles sinensis	1	-	3	1	1
Anopheles subpictus	-	-	2	-	1
Anopheles vagus	1	5	26	16	9
Armigeres (species)	1	-	-	-	-
Coquillettidia crassipes	2	2	17	7	1
Coquillettidia ochracea	-	-	-	1	-
Culex annulus	-	1	2	-	-
Culex bitaeniorhynchus	2	1	11	4	1
Culex fuscanus	-	-	-	1	-
Culex fuscocephala	2	6	66	36	26
Culex gelidus	17	75	368	415	110
Culex nigropunctatus	-	-	1	-	-
Culex pseudosinensis	-	-	1	-	-
Culex quinquefasciatus	15	19	73	64	68
Culex sinensis	-	-	6	-	-
Culex tritaeniorhynchus	1	9	62	18	7
Culex vishnui (subgroup)	3	6	41	37	11
Culex whitmorei	2	8	3	3	-
Culex (species)	-	-	12	4	2
Ficalbia aurea	-	-	1	-	-
Ficalbia chamberlaini	2	2	14	9	1
Ficalbia hybrida	2	1	35	13	3
Ficalbia luzonensis	-	-	10	6	4
Ficalbia minima	-	-	6	3	-
Mansonia annulifera	1	1	25	12	-
Mansonia dives	-	-	-	-	2
Mansonia indiana	-	-	4	-	-
Mansonia uniformis	20	9	46	19	9
Uranotaenia campestris	-	-	-	1	-
Uranotaenia (species)	-	-	-	1	-
Aedes males	1	3	-	-	-
Anopheles males	-	2	1	-	-
Armigeres males	-	-	-	1	-
Coquillettidia males	1	-	2	-	-
Culex males	34	74	29	30	9
Ficalbia males	-	2	2	-	1
Mansonia males	8	8	6	2	-
DAMAGED	2	1	96	105	25
TOTALS	127	240	1040	854	306

ADULT MOSQUITOES: YOKOTA, TACHIKAWA, AND FUCHU ABs, JAPAN, 1974

Species	Jul	Aug
Aedes vexans nipponii	3	-
Anopheles sinensis	3	5
Culex quinquefasciatus	6	2
Culex tritaeniorhynchus	3	5
Culex males	1	1
DAMAGED	2	1
TOTALS	18	14

IV. INTERPRETATION OF LIGHT TRAP DATA:

The adult mosquito surveillance program of most PACAF bases is designed around the New Jersey light trap (NJLT). One or more NJLTs are operated on a base for variable number of nights per week. Any mosquitoes captured are sent to the 1st Medical Service Wing Vector Taxonomy Unit (VTU) for identification. After a short period of time, the submitting unit receives a form from VTU stating that "x" number of "y" mosquito species were captured on "z" dates. The form is dutifully read by the submitting unit and then is filed with a shrug of the shoulders along with all other like forms which have accumulated over the years. Obviously, there should be more to a mosquito surveillance program than this, but all too often, there is not.

A number of questions pertaining to light trap data have been asked by the field and are indicative of some of the problems faced by base-level personnel. These questions include, "why should we run light traps when the VD program has us maxed out;" "how useful is the data obtained from light traps since we don't know what any of it means;" "what is the use of all those long names with the numbers behind them;" and "how many mosquitoes per night constitute a threat to health and/or morale?" Questions of this nature indicate a serious and on-going lack of school training in the spectrum of uses of the NJLT; however, they are all valid questions and deserving of answers. The following section is offered as a "correspondence course" in the use and interpretation of light trap data, both to answer the questions of the field and to maximize the use of data obtained from light traps on PACAF bases.

The following information can be derived from light trap catches, in order of increasing sophistication.

a. The day-to-day efficiency of the base-level mosquito control program can be evaluated.

b. The presence of certain disease vectors on the base can be detected, their numbers determined, and this information correlated with the incidence of vector-borne disease on and off base.

c. The fluctuation of total numbers of captured mosquitoes or of selected mosquito species can be followed over time, so that periods of heavy mosquito populations and periods when disease vectors are present can be predicted.

Light traps can be used to determine the efficiency of on-going mosquito control programs simply by counting the mosquitoes recovered every morning and telephonically reporting these raw numbers to the Civil Engineer Entomology Section prior to sending the mosquitoes to VTU for identification. This measure gives the entomologists an immediate idea of their fogging efficiency, or when and where to initiate fogging if fogging is not routinely performed.

Identification is necessary to detect the disease vector species present on a base. This is the reason that bases are requested to submit all mosquitoes captured to VTU for identification. After mosquitoes are identified, an identification sheet, 1MSEW Form 2, is prepared on each shipment and returned to the submitting unit. A valid criticism of this procedure in the past has been that there was no indication as to which mosquitoes identified were vectors and which were not. The inclusion of a list of disease vectors in the PACAF area (Section VI) will correct this oversight. By comparing this list with VTU identifications, the presence of vectors on base can be immediately determined by base-level personnel.

Finally, by properly manipulating light trap data accummulated over a period of several years, times of peak mosquito activity can be predicted, as can peak activity periods of selected species. To do this, however, a certain amount of simple data processing is necessary. Specifically, the raw data received from the light traps must be converted to a form which allows the data to be compared directly with previously collected data. The easiest way to do this is to calculate weekly trap night indices (TIs). TIs are calculated as follows:

$$TI = \frac{\text{Total female mosquitoes captured in one week}}{\text{Total trap nights in that week}}$$

One trap night equals one trap operated for one night. This figure is normally calculated by multiplying the number of traps operated by the number of nights that they are operated, such that two traps operated for three nights equals six trap nights, etc. If a trap malfunctions, it is not included in the trap nights figure and the denominator of the TI equation must be adjusted as will be shown in the following example.

For example, let us assume that during the first week in July the following light trap data was obtained on a PACAF Air Base, which routinely operates three light traps.

Date	Light Trap No.	No. Female Mosquitoes
3 Jul	1	6
3 Jul	2	15
3 Jul	3	22
4 Jul	1	0 (trap operated, no mosquitoes)
4 Jul	2	4
4 Jul	3	11
5 Jul	1	3
5 Jul	2	0 (trap inoperational)
5 Jul	3	8

The TI would then be calculated as follows.

$$TI = \frac{(6+15+22+0+4+11+3+8)}{(3 \times 3) - 1} = \frac{69}{9-1} = \frac{69}{8}$$

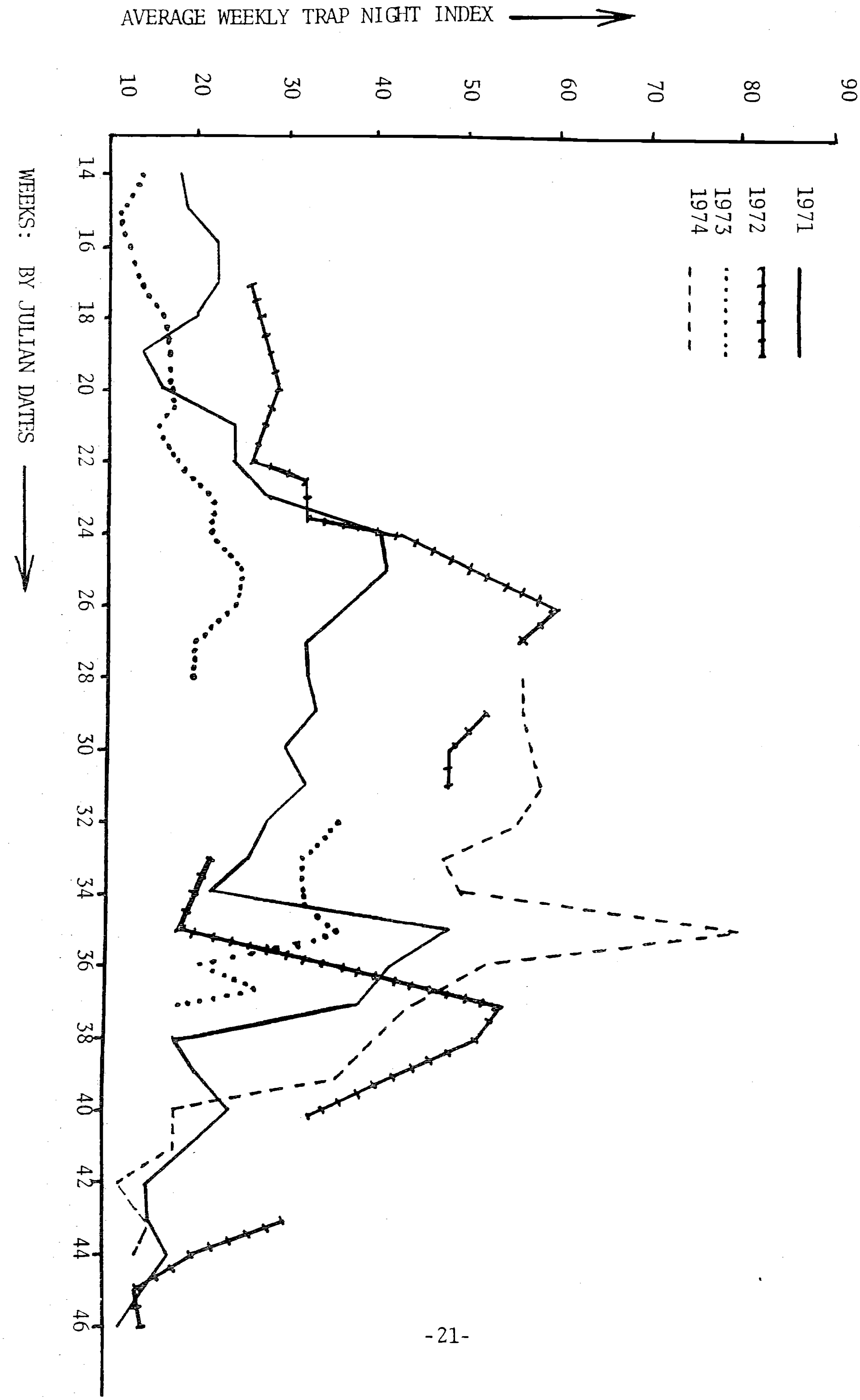
$= 8.6$, or $TI = 9$ to the nearest whole number

(Note that when a trap is inoperational, such as Trap 2 on 5 July, it is not figured into the equation, but when a trap is operated and the catch is zero, such as Trap 1 on 4 July, it is counted in the denominator of the TI equation).

As the weekly TIs are calculated, they should be plotted on a graph such as the one on the following page. The same graph is used for consecutive years for comparison purposes. Such a graph can show a number of useful things.

a. Yearly periods of peak mosquito activity can be identified and predicted. This information can then be used for mosquito control planning. In other words, TIs accumulated over a number of years can be developed into a predictive tool.

b. After several years of plots have been accumulated on the graph, abnormally high or low numbers of mosquitoes can be seen. Such variations might be due to abnormal weather conditions, failure of control equipment, or a change in control procedures. The causes of any fluctuation noted should be determined whenever possible.


AVERAGE WEEKLY TRAP NIGHT INDEX
10
20
30
40
50
60
70
80
90
1971
1972
1973
1974
WEEKS: BY JULIAN DATES
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46

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c. In countries such as Kored, where mosquitoes do not breed throughout the year, or on bases such as Hickam, where normally low mosquito populatiens make a base fogging program unnecessary, except for unusual outbreaks, graphed TIs can be used to determine the optimum times for beginning and ending control measures, or of establishing temporary control measures.

d. There is another type of TI which can be used to follow the fluctuations of one or more species of mosquitoes which are disease vectors or extreme pests. In this Specific Trap Index (STI) only the species or combination of species being followed is calculated and graphed as shown by the following examples.

(1) For Aedes vexans (a pest species):

$$STI = \frac{\text{Female Aedes vexans captured in one week}}{\text{No. of trap nights in that week}}$$

(2) For Japanese B encephalitis vectors on Taiwan:

$$STI = \frac{\text{Female Culex tritaeniorhynchus + C. fuscocephala + C. annulus}}{\text{No. of trap nights in that week}}$$

Cumulative STIs can be used in the same manner as cumulative TIs for prediction of peak mosquito population periods and for maximizing the effectiveness of control measures. They are routinely used in several areas of CONUS for accurate prediction of disease outbreaks, whereby if the STIs exceed an experimentally determined level, an outbreak of the disease vectored by the mosquito species being followed can be predicted. Unfortunately, such "magic numbers" for the PACAF area have not been established.

It is hoped that publication of this "correspondence course" in light trap data utilization will answer at least the most common questions which have been asked by the field, and that the continued use of light traps for mosquito surveillance has been sufficiently justified in the minds of the personnel tasked with conducting this surveillance. Any questions which have not been answered may be addressed to 1MSEW/SGB at any time.

V. ALTERNATIVE MOSQUITO SURVEILLANCE METHODS:

AFR 161-1, PACAF Supplement 1, requires all PACAF bases to perform mosquito surveillance; specifically, light trap surveys for adult mosquitoes and dipping surveys for larvae are to be accomplished at designated intervals. These methods were chosen because they combine relatively efficient mosquito surveillance methods with minimal time spent in accomplishing the program. Most

vector and pest species are readily captured in light traps, but several significant vector species are not attracted to light and their presence on a base might not be detected by use of the light trap. These species include Aedes aegypti and A. albopictus, vectors of dengue and hemorrhagic fever in Thailand and the Philippines, Anopheles flavirostris, the most significant Philippine malaria vector, and Anopheles minimus and A. balabacensis, which vector malaria in Thailand.

Larval surveys are an excellent method of determining the species present on a base and their relative abundance; however, this method requires a large amount of time and effort expended as well as a working knowledge of where the various mosquito species breed. For these reasons, larval surveys performed by base level personnel are not always as productive as desired.

A number of other mosquito surveillance methods can be used to detect species that are not attracted to light. Most of these methods use specialized equipment or require an unacceptable amount of time be spent in their performance; however, several methods can easily be accomplished at base level and may be used whenever desired. The following alternative methods of mosquito surveillance are briefly outlined.

a. Landing Collections

b. Biting Collections

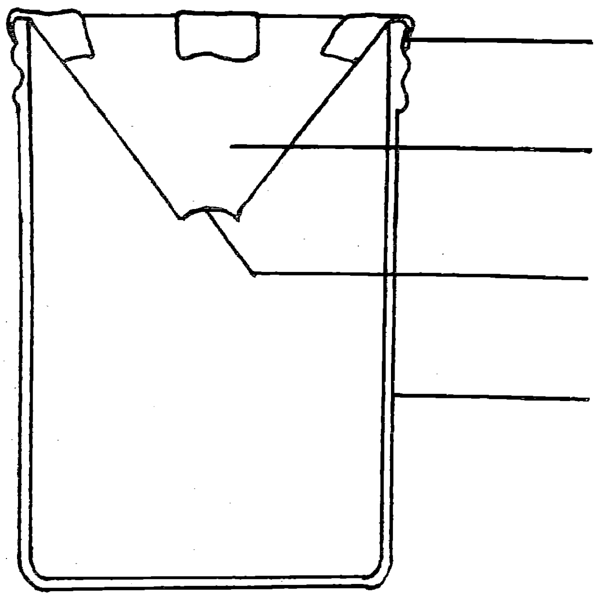
c. Resting Collections

d. Ovitrap Collections

e. CO_2 Baited New Jersey Traps

a. Landing Collections.

Two individuals are necessary to perform a landing collection survey. The first individual counts or collects the mosquitoes which land on the second individual who acts as "bait." A landing rate is then calculated on the basis of the number of mosquitoes landing on the bait during a given time period, which can be from 1 to 15 minutes. This method is not recommended in areas that do not support high populations of day-biting mosquitoes, as not enough mosquitoes will be collected to justify the time expended. It is preferable to collect the mosquitoes attracted during a landing collection survey so that they can be identified. This can be done with an aspirator, a chloroform tube, or with the simple collection device diagrammed here.



Mosquitoes enter through the hole in the paper, but seldom find their way back out. Many mosquitoes can be captured in this manner with very few escaping through the hole in the paper cone.

b. Biting Collections.

Biting counts are similar to landing counts except that only those mosquitoes that bite are collected. This is the most precise method available of determining what species are biting man, as only those that "sink their fangs" are collected by one of the methods described in the preceding paragraph. The mosquitoes can be collected from the back and torso of an individual serving as bait by a second individual, or the collector can sit on a chair, remove his shoes and socks, roll up his trouser legs, and collect the mosquitoes that bite his legs and feet. This procedure is not recommended in areas where a vector-borne disease outbreak is in progress, or where vector-borne disease is known to be endemic, unless suitable vaccination or prophylaxis is available and used.

c. Resting Collections.

Many mosquitoes are active only during the night and seek shelter in dark, quiet resting places during the day. If these resting places can be discovered, it is possible to collect mosquitoes, often many mosquitoes, with a minimum of effort. Places where mosquitoes normally rest include animal burrows, brush piles, between exposed tree roots, under tree bark, in holes in trees, in the vegetation and roots along streams, klongs, or benjos, privies, pigsties, bunkers, human habitations, under bridges and culverts or in almost any other type of dark,

sheltered undisturbed area. A flashlight is useful for optimum collection of mosquitoes in their resting sites, as most of these sites are dark. If the flashlight is held at an angle to the resting site, the mosquitoes will throw a larger shadow and be easier to detect.

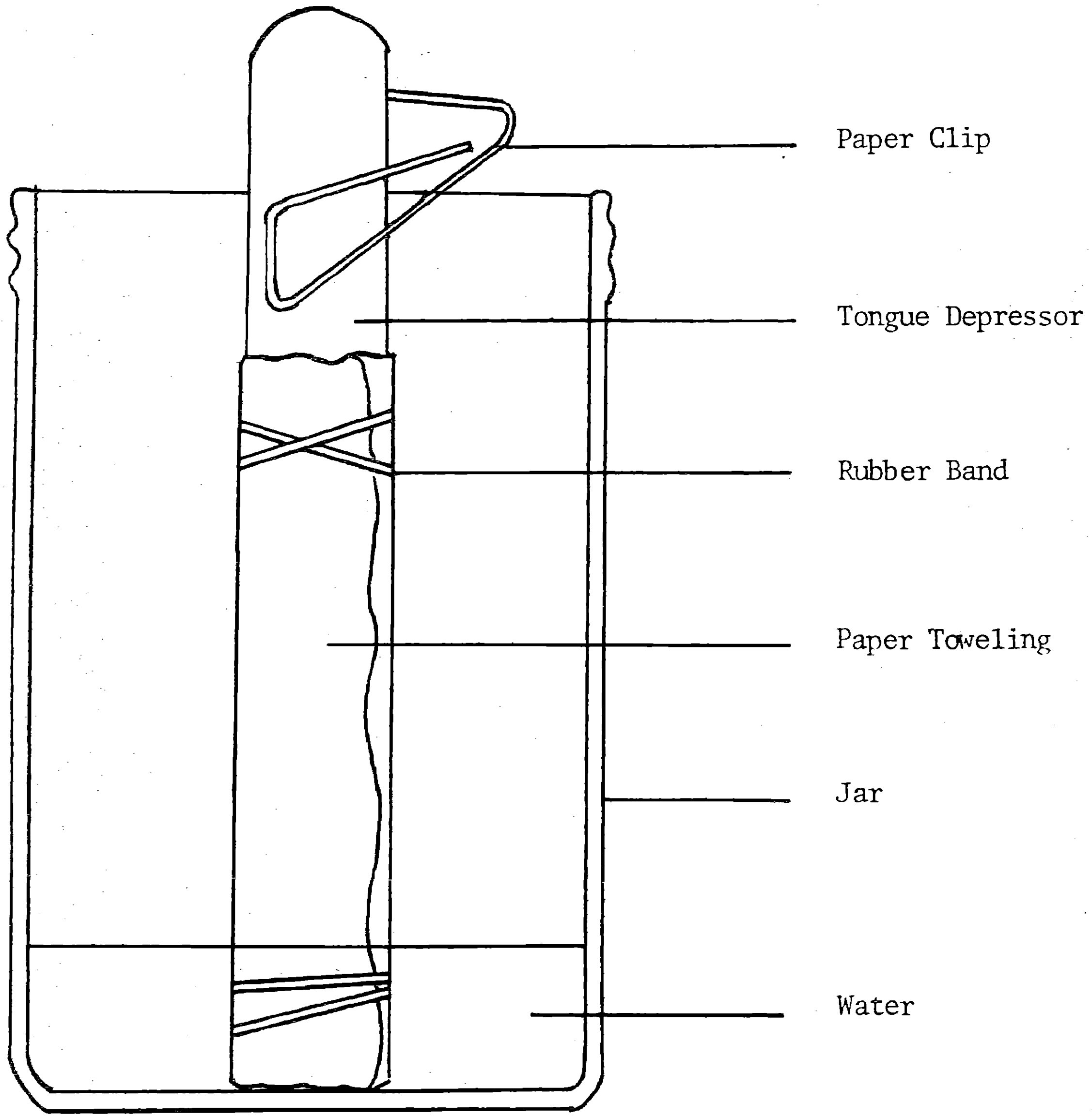
d. Ovitrap Collections.

Aedes aegypti and A. albopictus are extremely important disease vectors in the PACAF area, due to their role in the transmission of dengue, hemorrhagic fever, and chikungunya in Thailand and the Philippines. Neither of these species is attracted to light and their collection in light traps is unusual even when they occur in the trap area in large numbers.

Because of the desirability of detecting the presence of these species and the lack of interest they show in light, another method for their surveillance has been developed, based on the egg-laying habits of these species. Both species prefer to lay their eggs in small artificial containers filled with water, with the eggs deposited on the container surface at the water line. Based on these facts, the Ovitrap, otherwise known as the LBJ (Little Black Jar) was developed by the U. S. Public Health Service in the middle 1960s for use in the Aedes aegypti Eradication Program then in progress in the United States. The Ovitrap consists of a one-pint, wide-mouth jar, coated on the outside with glossy black paint. For use, the jar is filled to a depth of approximately one inch with water. A paddle made by wrapping paper toweling around a tongue depressor and securing with rubber bands is then fastened to the side of the jar with a large paper clip, as depicted in the following figure.

These traps are set out in sheltered, dark areas such as under bushes and under houses, but close to the edge of such areas. Enough Ovitraps should be set out to offer a large number of oviposition areas to the Aedes mosquitoes--a minimum of 10 per city block is recommended--and at least 100 per base at one time. The location of all Ovitraps set out should be carefully documented so that all are found. The traps should be visited every seven days, the water replenished and the paddles exchanged for new ones.

The paddles should be sent to 1MSEW for examination for mosquito eggs. The water in the traps should also be examined for the presence of mosquito larvae and any larvae found should be preserved in MacGregors Solution (see Section VIII-3) and sent to 1MSEW for identification. As several mosquitoes, in addition to Aedes aegypti and A. albopictus, oviposit in this habitat, it is necessary to identify the eggs and larvae rather than to automatically assume that any eggs or larvae found are of these two species.



Ovitraps are not a stocklisted item and probably cannot be obtained locally; however, 1MSEW has a large stock of Ovitraps and will be happy to issue them, along with more complete instructions, to any PACAF installation on request.

e. Carbon Dioxide Baited Traps.

Mosquito traps baited with carbon dioxide (CO_2) have several advantages over conventional New Jersey light-baited traps. These advantages include the following.

(1) Several species of mosquitoes that are not attracted to light are attracted to CO_2.

(2) Much higher numbers of mosquitoes are normally attracted to CO_2 baited traps than to light traps.

(3) CO_2 is not attractive to "trash" insects as light is. The catch in a CO_2 baited trap is almost 100 percent female mosquitoes. This feature saves a significant amount of time otherwise spent in sorting mosquitoes out of the trash insects.

The standard New Jersey light traps can easily be modified into a CO_2 baited trap, as diagrammed in Figure 1. The only modification of the trap itself is that a hole is drilled in the rain cover of the trap approximately one-third of the distance from the edge of the cover to the top. A length of Tygon or rubber tubing of a size to fit snugly through the hole is then inserted through the hole and tied securely to the large insect exclusion screen of the trap with string or wire; the other end of the tubing is attached to the CO_2 source.

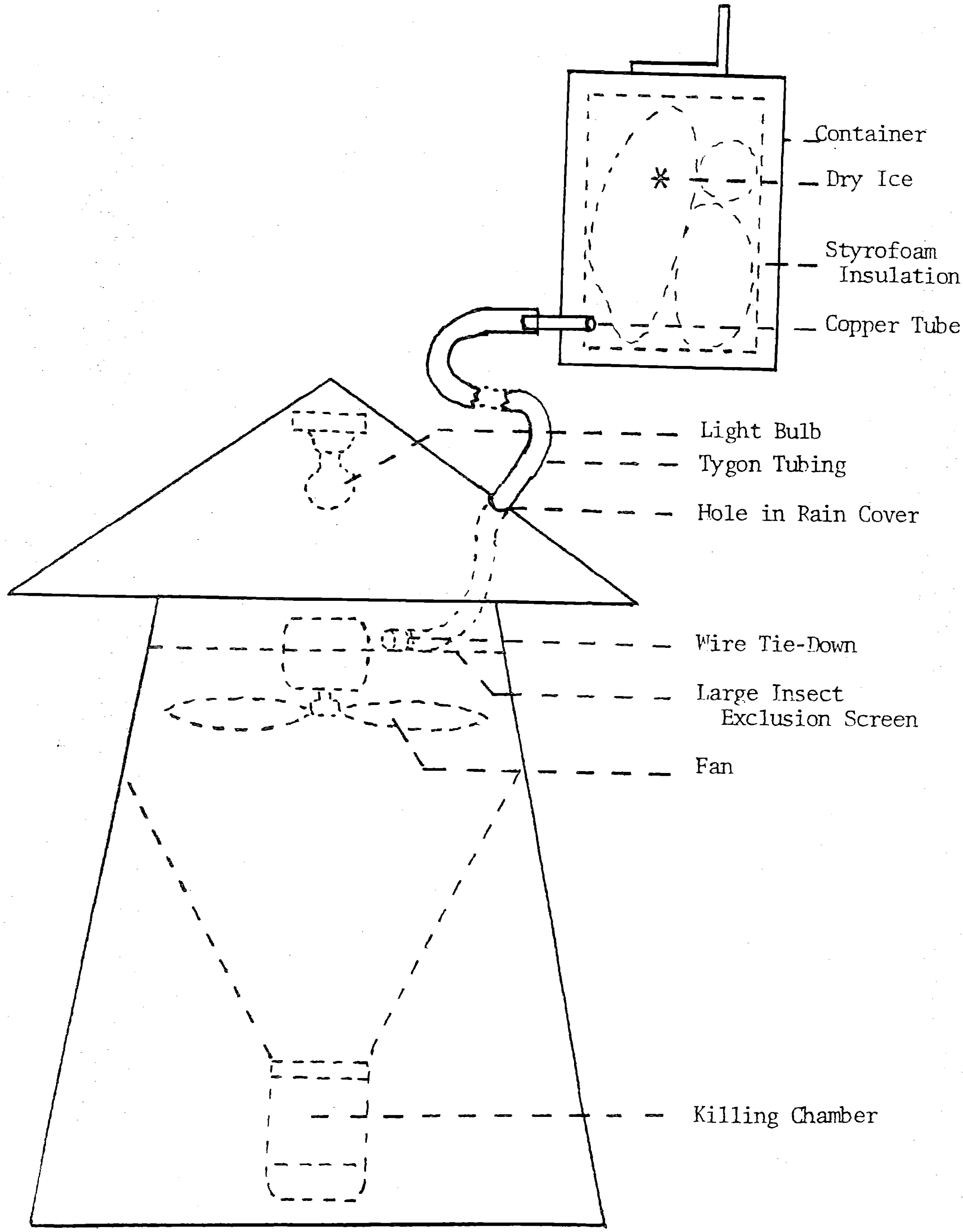
The CO_2 can be supplied in several ways. The easiest way under field conditions is to use blocks of dry ice in an insulated container. The container diagrammed in Figure 1 is a steel ammunition box which has been lined with 1/2-inch thick styrofoam or polyethylene foam insultation to prevent the dry ice from evaporating too rapidly. A small copper tube runs through the hole in the box and into the dry ice chamber, and extends 1 or 2 inches on the outside of the box to form a nipple for attachment to the tubing. This tube can be secured in place if desired by solder or hot melt glue. The evaporating dry ice builds up enough vapor pressure to force the CO_2 through the hose.

Another dry ice container that works quite well is a styrofoam dry ice shipping container (FSN 8115-682-6525); however, this will not take the abuse that the steel ammunition box will.

It is possible to use CO_2 directly from a tank, in which case the tubing is connected directly to the outflow nipple of the pressure guage on the tank. This method is the best from an experimental viewpoint, as the CO_2 flow can be precisely regulated and measured, but normally this method is of little use to the field, particularly in high pilferage areas.

For use, the trap can be operated from sunup to sundown as the unmodified light trap is, but it is preferable to operate it continuously, as CO_2 is attractive to day-flying mosquitoes during the daylight hours as well as to night-flying species. If the CO_2 baited trap is operated around the clock, it may be necessary to replace the dry ice every 12 hours. If desired, the light bulb may

FIGURE 1: Modified New Jersey Light Trap



be unscrewed or removed so that trash insects are not attracted to the trap.

All installations are urged to try the CO_2 baited traps, as data on the attractiveness of these traps to Asian mosquito species is scanty, although such data for American species is available. It is predicted that vector species not particularly attracted to light will be attracted to CO_2, and that the time expended in filling dry ice containers would be saved by the amount of time not needed to separate mosquitoes from trash insects.

1MSEW/SGBE has personnel assigned who are familiar with CO_2 trapping and should be contacted for more complete advice by any base planning to use CO_2 baited traps in their mosquito surveillance program.

VI. MAJOR MOSQUITO DISEASE VECTORS IN THE PACAF AREA:

Aedes aegypti	Dengue (Thailand, Philippines) Hemorrhagic Fever (Thailand, Philippines) Chikungunya (Thailand, Philippines)
Aedes albopictus	Dengue (Thailand)
Aedes poecilus	Bancroftian Filariasis (Philippines)
Aedes togoi	Malayan Filariasis (Korea)
Anopheles balabacensis	Malaria (Thailand)
Anopheles flavirostris	Malaria (Philippines)
Anopheles minimus	Malaria (Thailand)
Anopheles sinensis	Malaria (Korea, Japan)
Culex annulus	Japanese B Encephalitis (Taiwan)
Culex fuscocephala	Japanese B Encephalitis (Taiwan)
Culex gelidus	Japanese B Encephalitis (Thailand)
Culex quinquefasciatus	Bancroftian Filariasis (entire PACAF area)
Culex tritaeniorhynchus	Japanese B Encephalitis (Japan, Korea, Taiwan)

The PACAF area, as referred to in the above table, is restricted to Thailand, Taiwan, the Philippine Islands, Korea, and Japan. Many of the above species are also found in Vietnam, Laos, Cambodia, and Mainland China, and these countries also have numerous disease vectors that do not appear on the above list.

VII. BIOLOGICAL DATA FOR SELECTED MOSQUITOES:

A basic knowledge of the life histories and habits of the more common mosquitoes is a definite aid in the effective planning of base vector surveillance and control programs. With this idea in mind, basic information pertaining to the geographic range, larval and adult habitats, periods of peak activity, flight range, host preference, and disease and pest importance of several of the most important disease vectors in the PACAF area are summarized here.

Aedes aegypti (Linneus) 1762

Aedes aegypti breeds freely between 45°N and 35°S latitudes, which includes the entire PACAF area. It has been eradicated at one time or another from Okinawa, Guam and Oahu, but has become reestablished in Okinawa and Guam. Larvae are found primarily in water impounded in artificial containers such as cans, bottles, fire barrels, snail shells, etc., but this species will also breed in tree holes, rock pools and ground pools, provided that the water is clean. One of the most favored breeding places is in water impounded in rubber tires, and this habitat should always be included in base larval surveys, if available. The eggs of A. aegypti are quite resistant to drying out, and can remain out of water for six months or more without dying. The favored adult resting place is indoor habitations, although they may be found outdoors in shady places. A. aegypti is primarily an indoor, day-time biter throughout most of its range. Outdoor and night-time biting occurs, but is unusual, except perhaps in the Marianas. Bites are quite painful. Aedes aegypti feeds almost exclusively on man, and is seldom found more than 100 meters from human habitations or working areas. It is not a strong flyer, and most of its flights are short and characterized by frequent resting. Aedes aegypti is the primary vector of dengue and dengue hemorrhagic fever in Thailand and the Philippines, as well as in portions of Africa, Southern Europe and the Americas. It is also the classical vector of yellow fever, although this disease does not occur in the PACAF area.

Anopheles balabacensis balabacensis Baisas 1936

Anopheles balabacensis is found in areas of the Philippines, Malaysia, Indonesia, Thailand, Burma, Laos, the Khmer Republic, Vietnam, Taiwan, northeast India, and southern China. The larvae favor shaded streams and seepage pools in heavily wooded and foothill areas, but are also found in swamps, pools, hoofprints, if these non-typical sites are partially shaded or sunny, with clear water and silty bottom. Changes in the natural vegetation of jungle areas made by man, such as clearing jungle for agricultural purposes, may favor an increase in A. balabacensis populations. Adults normally rest in jungle foliage in areas with subdued light. They have also been

collected in palm hedges, mining pits, among shrubs under dead leaves, in stream banks, and inside houses. A. balabacensis bites throughout the night, and prefers to bite inside habitations rather than outside. It will characteristically rest on the outside of houses prior to entering them to feed, and after feeding leaves the house to rest under the eaves before leaving at dawn. Peak biting periods vary from early in the evening in portions of Indonesia to 0200-0300 in Thailand and Malaysia. Daytime biting is infrequent but has been observed in Thailand, Indonesia, and Malaysia. The flight range of this species is unknown. It appears to feed primarily on man, but females have been attracted to traps baited by bovines and monkeys. Anopheles balabacensis is a primary malaria vector in Thailand, India, Indonesia, Malaysia, and the Khmer Republic, and may also be a vector of simian malaria.

Anopheles flavirostris (Ludlow) 1914

Anopheles flavirostris is widespread on the larger islands of the Philippine Archipelago, and may be present in eastern Java. Its presence in Australia and India is more uncertain. Larvae favor the grassy edges of clear, partially shaded, slowly flowing streams, and can best be found among the exposed roots of trees along the banks or inside pools where water movement is minimal. They can also be found in slightly turbid, slightly polluted streams with submergent aquatic plants, and along the edges of lakes among water hyacinth plants if there is an undercurrent water flow. Adults rest outdoors during the day in cool crevices along stream banks and dugouts where there is vegetation and the earth is moist, or in crab burrows, moist tree holes, cracks in rotten logs, underneath roots and in bamboo thickets. A few may remain in housing during the day, but this is not common. This species bites indoors, with peak biting activity between 2300 and 0100. The normal flight range varies between 0.2 to 2.0 kilometers, with an average range of about 1 km. A. flavirostris would much rather feed on domestic animals, such as cattle and carabao, than on man, but in areas where domestic animals are scarce, man is used as an alternative food source. This preference becomes important in areas where new land is developed, but domestic animals are absent and the females have no choice but to feed on man to survive. A. flavirostris is the most important malaria vector in the Philippines, and is a possible vector of Bancroftian filariasis.

Anopheles minimus minimus Theobald 1901

Anopheles minimus is widely distributed in Asia, being found in portions of India, Pakistan, Burma, Thailand, Laos, the Khmer Republic, Vietnam, southern China, Indonesia, and Malaysia. Favored larval breeding areas are streams in hillside and foothill areas

where water is slow flowing, clear and with partially shaded grassy edges. Larvae can also be found in the margins of swamps, drains, irrigation canals, shallow earth wells, and in marshes and in rice-fields with slowly running water. Adults prefer to stay indoors in any dark corner or area that is dark, humid, and undisturbed such as under beds and in cupboards. They are also found in the dark lower portions of the walls in cattle sheds or among bundles of straw. The period of peak biting activity is 2200 to 0200, although some biting occurs throughout the night. Anopheles minimus much prefers to feed on man, but is able to survive in wooded areas where man is not present, and will feed on cattle. The flight range is unknown. Anopheles minimus is a very efficient malaria vector, and with Anopheles balabacencis is responsible for the majority of the malaria cases in Thailand.

Anopheles sinensis Wiedemann 1828

The range of Anopheles sinensis includes China, Taiwan, Burma, Vietnam, Thailand, Korea, Japan, Malaysia, Indonesia, India and Afganistan. The larvae are normally found in clean water with low organic content, such as that in ricefields, natural ground pools, lakes with marginal vegetation, and newly cleared jungle areas. Adults prefer to rest during the day in cow stables and vegetation near the breeding places, or in habitations or storage areas adjacent to habitations. Biting takes place during the night, and starts approximately two hours after sunset. Most biting occurs inside. Flight range is unknown. A. sinensis prefers to feed on domestic animals, particularly cattle, but will readily bite man if mosquito populations are large or animals are scarce. A. sinensis is the major vector of malaria in Korea, Taiwan, and north and central mainland China. Adults have been found naturally infected with Brugia malayi (Malayan filariasis) in Korea, and it also vectors filariasis in portions of mainland China.

Culex (Culex) quinquefasciatus Say 1823

Culex quinquefasciatus is widely distributed throughout all tropical and semitropical countries. Larval breeding sites are in ground water or in containers, and water with a high degree of organic pollution is preferred, as is shade. Larvae are often found in open sewers, sewage pools, poorly closed cesspools, and dirty wells, as this species can tolerate very high amounts of organic contaminants in its breeding waters. Larave are often more abundant during dry months, as rainfall will flush them out of their breeding places. Periods of dry weather also concentrate the organic content of standing water and make it more attractive for breeding. Adults are often found resting in dwellings and other man-made structures. C. quinquefasciatus is a vicious biter and is a major pest species, particularly in urban situations. Biting activity begins at dusk,

reaches its peak in the early morning hours, and ends at dawn. Although flights of up to five kilometers have been recorded, distances of 0.5 kilometers or less are much more common, and it is not considered a migratory species. In addition to being a severe pest, C. quinquefasciatus is the chief vector of urban periodic Bancroftian filariasis throughout much of its range. There is a possibility that it is also a minor vector of chikungunya and Japanese B encephalitis.

Culex tritaeniorhynchus Giles 1901

Culex tritaeniorhynchus is widely distributed throughout large areas of Africa, southern Europe, the Middle East, and Asia, including the Philippine Islands, Thailand, Taiwan, Japan, Korea, and Vietnam. It breeds in a wide range of waters and may be found in fresh or polluted water, temporary and permanent pools with or without vegetation, ditches, ponds, and particularly in ricefields. It can also tolerate brackish water and is found in tidal marshes. Adult day-time resting places include cowsheds, pigsties, on damp rocks in the forest, ground vegetation, and inside houses. It is more commonly found in rural than in urban areas. Biting occurs mainly outdoors soon after sunset, and continues until 2000 or 2100, although this mosquito will also bite inside if attracted there by light. Biting rate is high at ground level but decreases with increasing altitude. The usual flight range is about one kilometer; however, dispersals of over eight kilometers have been recorded. The preferred hosts of C. tritaeniorhynchus are swine and cattle with some avian feeding noted, but in the absence of preferred hosts, they will readily feed on man. This species is the primary vector of Japanese B encephalitis (JE) in Japan, Korea and Taiwan. The feeding preference of C. tritaeniorhynchus for swine is of interest in the epidemiology of JE, as swine are an amplifying reservoir for JE. When JE reaches a high endemicity in the swine populations, it can spill over into the humans in the area.

VIII. PACKING AND SHIPPING SPECIMENS:

1. General Instructions.

All insect specimens submitted to 1MSEW for identification should be prepared for shipment as specified in the next paragraphs. Unless specific instructions to the contrary are given, only dead arthropods should be submitted for identification. If it is necessary or desired to ship live insect specimens, 1MSEW must be contacted for specific instructions prior to shipment, as there are international laws which govern the shipment of living organisms.

All specimens submitted to 1MSEW must be properly labeled so that the following data is included.

a. Locality - Place of collection (Clark AB, R. P.)

b. Source - Host or environment at time of collection (Light Trap No. 3, Larval Station 5, inside Bldg 555, etc.)

c. Collector - (SSgt Snorkel, Envmt Health Svcs)

d. Date - (Day, month and year of collection--NOT date mailed).

e. Remarks - Any additional pertinent information. (The inclusion of weather data is no longer necessary).

All shipments should be addressed to the following address.

Vector Taxonomy Unit
Hq 1st Medical Service Wing (PACAF)
APO 96528

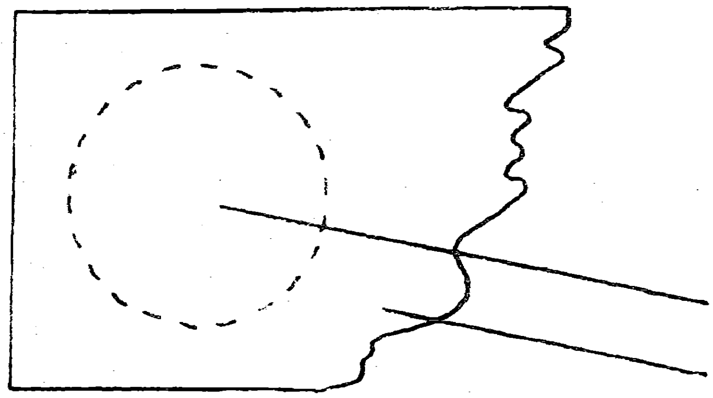
Please note that this is a different APO than that used for the rest of 1MSEW.

2. Adult Mosquitoes.

Specimens captured in light traps should be collected on the morning after they have been captured, separated from the "trash" insects in the light trap and packed for shipment as soon as possible. If the time between the end of the collection period and the time the mosquitoes are packed exceeds six hours, the specimens begin to dry up and become brittle. When such brittle mosquitoes are packed, legs, wings and other parts necessary for identification break off, and the mosquitoes cannot be identified. Poor collection discipline results in specimen loss due to compression by the weight of excessive numbers of insects, to mold formation, or to excessive killing time because the killing agent used cannot penetrate the large layer of insects accumulated.

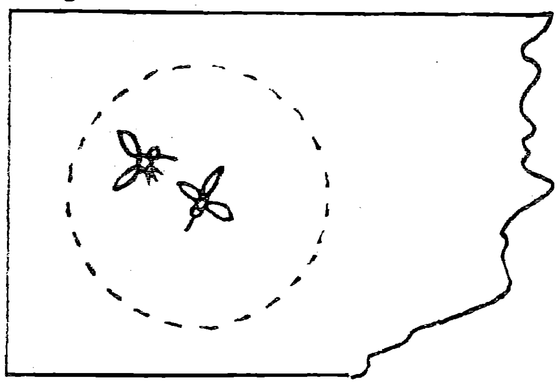
If mosquitoes are packed for shipment in the manner depicted in Figures 1 through 4, they almost always arrive in excellent condition so that all specimens are identifiable. The necessary packing materials are available to all Environmental Health Services Offices, and consist of facial tissues such as Kleenex (do not use toilet tissue) and Petri dishes for Millipore water cultures. (Dish, culture, Petri, top and bottom complete, FSN 6640-299-8689).

Figure 1



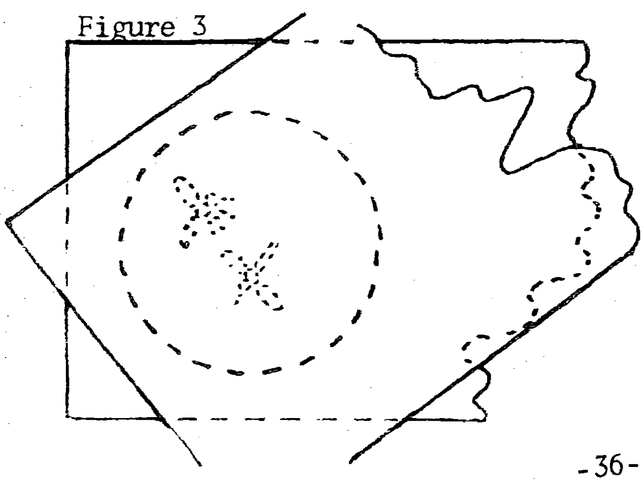
Place a piece of tissue over the bottom half of the culture dish, as diagrammed. The tissue must be large enough to completely cover the dish, with 1 inch of overlap on all sides.

Figure 2



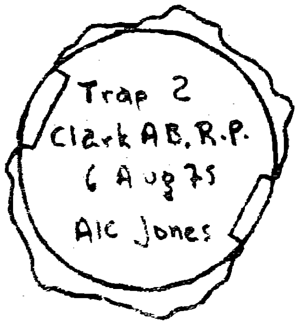
Place mosquitoes on the tissue covering the culture dish. Mosquitoes should be spread out so that they do not touch each other.

Figure 3



Cover the mosquitoes with a second piece of facial tissue.

Figure 4



Place the top of the culture dish on the bottom. Press the two halves together and tear off excess tissue. Tape the halves of the culture dish together so that they cannot separate in shipment. Write necessary data on the culture dish with a china marking pencil.

The culture dishes should be packed for shipment in a strong cardboard box which is large enough to insure that the dishes are surrounded on all sides by at least one inch of packing material. Packing material can be styrofoam chips, wadded tissues, paper towels, rolled newspapers or anything of this nature. The box should be taped securely shut so that it cannot open in the mail.

3. Larval Mosquitoes.

Ship all larvae from a single collection site in one container, but do not mix larvae from two or more collection sites. If possible, it is best to kill the larvae by placing them in hot, but not boiling, water. The water from a hot water tap is normally hot enough for this purpose. The hot water prevents the larvae from turning black and becoming difficult to identify. Drain the hot water from the mosquitoes before adding the preservative. If hot water is not available, the larvae can be placed directly in the preservative after all water has been drained from them.

In the past, most larvae have been preserved and shipped in 70 percent ethyl or isopropyl alcohol. These preservatives cause hardening and distortion of the larvae so that identification was made much more difficult. 1MSEW strongly recommends that MacGregors Solution, rather than alcohol, be used for preserving and shipping mosquito larvae. This is made by dissolving five grams of borax (sodium borate) in a small amount of water, then adding 2.5 ml of glycerine and 100 ml of 37 percent formaldehyde to the mixture, and finally adding sufficient distilled water to make a total volume of 1 liter (1000 ml).

(Sodium borate, USP, 6505-00-141-9000, 1 lb bottle @ $0.31 per bottle)

(Glycerine, USP, 6505-00-153-8220, 1 lb bottle @ $0.81 per bottle)

(Formaldehyde solution, USP, 6505-00-264-6199, 1 qt bottle @ $0.89 per bottle)

The collection data specified in the General Instructions paragraph should be written on a small piece of paper and inserted into the preservative along with the larvae. It is important that only pencil or water-proof India ink be used to write the collection data, as any other type of ink will dissolve in the preservative.

The bottles or vials used to ship the mosquitoes should be completely filled with preservative, with no air bubbles apparent. A screw-cap vial or bottle is easier to fill completely than is one that has a cork stopper.

For shipment each vial should be wrapped individually in several layers of paper towel, cellucotton, or similar substance. These wrapped vials can then be packed by the same method as described for packing adult mosquitoes, and mailed to 1MSEW for identification.

4. Other Insects and Arthropods.

1MSEW will attempt identification on any other insect or insect relative which may be of possible medical or economic importance, but pretty beetles, butterflies, etc., which are obviously of no medical or economic importance, will not be identified. Types of insects and arthropods which 1MSEW will attempt to identify include flies, fleas, lice, ticks, spiders, and scorpions. Insects found infesting stored food products will also be identified upon request. Insects other than mosquitoes should not be sent to the Vector Taxonomy Unit for identification, but directly to:

1st Medical Service Wing/SGBE
APO 96274

All hard-bodied insect specimens other than mosquitoes which are submitted for identification should be preserved in 70 percent ethyl alcohol or 70 percent isopropyl alcohol. Soft-bodied insects, fly larvae, etc., should be shipped in MacGregors solution. Labels should be placed in each vial or bottle with the same data supplied as described in the General Instruction section. The vials should then be packed in the same manner as vials of mosquito larvae and mailed to 1MSEW.

5. Rodents and Snakes.

Please do not mail rodents or snakes for identification without first contacting 1MSEW. There is normally no reason to mail rodents or snakes to 1MSEW.